From: Gibson, Sandy P CIV USARMY CEPOA (US) <Sandy.P.Gibson@usace.army.mil>
Sent: Wednesday, August 30, 2017 5:36 PM
To: ERM Mountain West ASAP SEIS Project
Subject: EPA 3a letter (permit application) (UNCLASSIFIED)
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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OFFICE OF
ENVIRONMENTAL REVIEW
AND ASSESSMENT

AUG 2 9 2017

Colonel Michael Brooks
Alaska District Engineer
U.S. Army Corps of Engineers
P.O. Box 6898
JBER, Alaska 99506-0898

Dear Colonel Brooks:

The U.S. Environmental Protection Agency Region 10 has reviewed the above-referenced Public Notice, which describes the Alaska Gasline Development Corporation's proposal to discharge fill for the construction of an in-state gas supply pipeline, known as the Alaska Stand Alone Pipeline. The proposal was submitted under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.[1] The proposed project includes a 733-mile-long, 36-inch diameter natural gas transmission mainline extending from Prudhoe Bay to an existing pipeline system in Southcentral Alaska. The project also includes a natural gas conditioning facility in Prudhoe Bay capable of producing an annual average of 500 million standard cubic feet per day of utility-grade natural gas at peak capacity. Approximately 8,907 acres of wetlands would be directly impacted. This includes approximately 7,573 acres of permanent wetland loss, 1,161 acres of temporary impacts via the discharge of gravel for construction pads or building of ice pads, 1 acre of permanent intertidal loss, and 171 acres of subtidal impact, as a result of the pipeline, aboveground facilities, permanent access roads, and marine dredge fill. The project also includes 312 stream crossings, including 64 crossings of anadromous waters, as well as impacts to the Yukon, Tanana, Nenana, and Susitna Rivers. Approximately 1,037 acres of wetlands underlain by permafrost would also be subject to degradation from the proposed project.

The Army Corps of Engineers Alaska District made the Public Notice available for comment concurrently with the release of a Draft Supplemental Environmental Impact Statement, for which the Corps serves as lead federal agency. In addition to reviewing the Public Notice, the EPA has actively participated as a cooperating agency in the National Environmental Policy Act process for the ASAP project, including the 2012 Final EIS, and the 2017 Draft SEIS. Following the 2012 Final EIS, the applicant made changes to the project that were not evaluated in that document, including changes related to the location of material sites, access roads, and other project infrastructure. Changes also included changes to the diameter of the pipeline, location of dredging and disposal work, and pipeline routing. These changes led to preparation of the 2017 Draft Supplemental EIS. Throughout the NEPA process, we have participated in agency work groups and have provided extensive comments on prior versions of the EIS. Our comments reflect the EPA's ongoing experience with the ASAP project and the anticipated impacts.

The EPA understands and supports Alaska's desire to develop its energy resources in a responsible way that addresses the needs of Alaskans while also safeguarding the State's exceptional natural resources. We are also aware that the proposed project would provide a source of cleaner energy to the Fairbanks

[1] 33 U.S.C.§ 1344, 33 U.S.C. § 304.

area, whose air quality is adversely affected by widespread combustion of wood and coal. We have certain concerns, however, regarding the information provided to date and offer the following comments to ensure that the ASAP project can be reviewed in an expeditious manner that complies with the Clean Water Act's Section 404(b)(1) Guidelines.

The Public Notice on the proposed ASAP project did not include information required by both the EPA's and the Corps' regulations on how impacts associated with the proposed activity are to be avoided, minimized, and compensated for, a troubling omission for a project of this scope and scale.[2] We note, however, that a Draft Compensatory Mitigation Plan prepared by the applicant was subsequently posted on the Corps' website along with the Draft SEIS. According to the Draft CMP, of the approximately 8,907 acres of direct wetland impacts, the project proponent is proposing to provide compensatory mitigation for impacts to approximately 104.97 acres (approximately 1 percent of the impacted wetland area). The Draft CMP proposes to provide this compensatory mitigation by securing an appropriate number of credits from approved mitigation banks.

Based on our review of the Public Notice, the Draft SEIS, and the applicant's Draft CMP, the EPA is concerned that the proposed project may not comply with the Guidelines. Specifically, it is not clear that the proposed project's direct, secondary, and cumulative impacts on aquatic resources have been adequately evaluated to support the factual determinations required by the Guidelines.[3] It is also not clear that all appropriate and practicable steps have been taken to ensure that impacts to aquatic resources have been avoided, minimized, and compensated for, consistent with the Guidelines.[4]

The Guidelines direct that no discharge of dredged or fill material shall be permitted if the discharge will cause or contribute to significant degradation of waters of the United States.[5] Determinations regarding significant degradation are made based on an analysis of the direct, secondary, and cumulative impacts of the proposed project on the aquatic ecosystem. The proposed ASAP would traverse 60 watersheds (as defined by the USGS 10-digit Hydrologic Unit Code or HUC-10) in Alaska's Northern, Interior, and Southcentral ecosystems. Although the project would adversely impact wetlands, streams, and other aquatic resources in all 60 watersheds, the Draft CMP uses a novel approach to summarily dismiss potential impacts on the aquatic ecosystem in all but two of these watersheds as "insignificant." This conclusion is particularly remarkable since the Draft SEIS assigns some of these same wetland impacts (e.g., wetland loss and fragmentation) a "major" or "moderate" negative effects ratings. The Draft CMP argues that the only ecologically significant impacts to wetlands would be those that occur in watersheds that have experienced greater than 7.5 percent anthropogenic disturbance. Thus, of the approximately 8,907 acres of potential direct wetland impacts estimated for ASAP, the Draft CMP identifies only 104.97 acres as ecologically significant, and does not consider the indirect losses from permafrost degradation at all. All of the impacts to the remaining 8,802 acres of wetlands are dismissed as insignificant regardless of the existing quality of these wetlands, the functions they provide in the landscape, the degree to which those functions would be impacted, the duration of those impacts, or the likely ecological consequences. The EPA is not aware of any other case in which this approach has been used in the context of an impacts analysis pursuant to the Guidelines. The EPA is particularly concerned about employing such a novel approach without independent evaluation for a project that involves the scope and scale of impacts to aquatic resources anticipated for ASAP. In light of these gaps and

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[2] *See* 40 C.F.R. § 230.94(b), 33 C.F.R. § 332.4(b).
[3] *See* 40 C.F.R. §§ 230.5, 230.11, 230.12.
[4] *See* 40 C.F.R. §§ 230.10(a), 230.10(d), 230.91 – 230.98,
[5] 40 C.F.R. § 230.10(c)

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inconsistencies in the impacts analysis the EPA is concerned that there is insufficient information to make a reasonable judgment as to whether the proposed discharges will comply with the Guidelines.

The Draft CMP identifies measures taken to avoid and minimize adverse impacts to wetlands, streams, and other aquatic resources as part of ASAP's planning and design. These include avoiding open water areas and higher value wetlands by routing the pipeline through uplands or areas with fewer wetlands and by using construction methods designed to result in only temporary impacts. Nevertheless, there appear to be additional appropriate and practicable avoidance and minimization measures that could further reduce potential aquatic resource impacts. For example, the DSEIS indicates that potentially thousands of acres of impacts could be avoided by elevating the pipeline on using vertical support members in wetland areas underlain by permafrost, similar to the existing Trans-Alaska Pipeline. The EPA believes that opportunities to elevate the pipeline should be more thoroughly evaluated to determine if they could reduce the impacts to wetlands underlain by permafrost. We also recommend evaluating the use of Dock Head 4 at West Dock and removal of gravel in the construction right-of-way as potential opportunities to minimize impacts to resources. Such additional evaluations are critical to adequately identify the least environmentally damaging practicable alternative under the Guidelines.[6]

The EPA also has a number of concerns regarding the adequacy of the proposed compensatory mitigation. Compensatory mitigation involves the restoration, establishment, enhancement, and/or in certain circumstances preservation of wetlands, streams, and other aquatic resources for the purpose of offsetting unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization has been achieved.[7] Compliance with the Guidelines may require compensatory mitigation to reduce the magnitude or severity of certain discharges to avoid the potential for significant degradation. Compliance with the Guidelines may also require compensatory mitigation when such measures are appropriate and practicable – *i.e.,* appropriate to the scope and degree of the impacts and practicable in terms of cost, existing technology, and logistics in light of overall project purposes. In this case, because of the lack of information in the Draft CMP regarding the direct, secondary, and cumulative impacts of the proposed discharges on approximately 99 percent of the potentially affected wetland acreage discussed above, sufficient information does not exist to determine if additional compensation would be required to avoid causing or contributing to significant degradation. For the same reason, sufficient information does not exist to determine if there are appropriate and practicable compensation measures that would be required by the Guidelines to address some or all of the remaining approximately 8,802 acres of wetland impacts where compensation is not currently proposed. In addition, for the 104.97 acres of wetland impacts that the permit applicant has identified as needing compensation, the EPA is concerned that the assessment method utilized to evaluate the type and levels of functions these wetlands provide inappropriately undervalues their current functional capacity. Overall, the EPA believes that such extensive, unmitigated destruction and degradation of wetlands and aquatic resources, particularly in aquatic resources underlain by permafrost, may not comply with the Guidelines.

The EPA has previously raised concerns with the Alaska District at the staff level, with the Statewide Interagency Review Team, and at the management level over identified lack of compensatory mitigation or inadequate compensatory mitigation for recently permitted projects, and has questioned these projects' compliance with the Guidelines, particularly the 2008 Final Rule. We note, as previously stated, that the applicant's proposal may not comply with the Guidelines for similar reasons, and we

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[6] *See* 40 C.F.R. § 230.10(a).

[7] *See* 40 C.F.R. § 230.92.

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believe that separate discussions of the larger policy issues between our agencies are needed to address our concerns.

Based on our review of currently available information and the concerns articulated above and in our attached comments, and pursuant to Part IV, paragraph 3(a) of the 1992 Clean Water Act Section 404(q) Memorandum of Agreement between the EPA and Department of the Army, the EPA is hereby notifying the Alaska District that the proposed discharges may result in substantial and unacceptable impacts to aquatic resources of national importance, including the wetlands and waters of the Yukon River basin. Notably, many of the aquatic resources along the proposed pipeline route are of outstanding natural resource value and occur in systems whose ecological functions are intact. In particular, the EPA concludes that the Yukon River basin, with its associated tributaries and wetlands, and adjacent wetland systems, is an aquatic resource of national importance according to the criteria identified in the Section 404(q) MOA. Aquatic resources that are underlain by permafrost are of particular concern, since these resources provide unique functions in addition to the general functions that wetlands provide. They are fragile, easily damaged, and do not recover from damage in less than one generation, if at all. Furthermore, the wetlands and streams of the Yukon basin provide important functions that help to maintain the basin's ability to support and maintain anadromous fish, particularly salmonids, which are of both commercial and subsistence imporance. In accordance with paragraph IV(3)(b) of the Section 404(q) MOA, EPA will provide further comments on this matter within 25 calendar days after the end of the extended comment period. Because that date falls on a weekend, that letter would be due no later than September 25, 2017.

Thank you for the opportunity to provide comments on the proposed ASAP project. I appreciate the attention that you and your staff have provided to this project, and EPA Region 10 looks forward to discussing our concerns. In the meantime, my staff is working to identify ways in which we can work together to ensure that any unavoidable impacts are adequately offset with appropriate and practicable compensatory mitigation. Should you have any questions about this letter, please do not hesitate to contact me or have your staff contact Mark Douglas at (907) 271-1217, or by email at douglas.mark@epa.gov.

Sincerely,

R. David Allnutt, Director
Office of Environmental Review and Assessment

Attachment

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Attachment 1: The Wetlands and Streams of the Yukon River Basin are an Aquatic Resource of National Importance

The Yukon River is the third longest river, and the longest free-flowing river, in North America, flowing northwest from the Coastal Range mountains of northern British Columbia, through the Yukon Territory and Alaska to the Bering Sea. The river is 1,980 miles long and empties into the Bering Sea at the Yukon-Kuskokwim Delta. It drains a total watershed area of 321,500 mi^2, of which 126,300 mi^2 is in Canada, and is the fourth largest basin in North America. It is also the fifth largest contributor of freshwater to the Arctic Ocean. Its contributing rivers drain a number of different biogeographic regions, from the Arctic, to the Alaska Range, and include a variety of both glaciated and unglaciated systems.

Background and History

Humans have inhabited the Yukon basin for thousands of years, and may it be one of the oldest settlements of humans on the continent. Those that did not trade with the coastal Tlingit people remained culturally isolated until the 19th century (Brabets *et al*, 2000). Exploration of the Yukon during the earlier part of the 19th century was geared toward developing the fur trade. Following the purchase of Alaska in 1867, when fur trading was the primary commercial activity, the Alaska Commercial Company constructed several posts at various locations on the Yukon River. In the 1870's, Leroy McQuesten, Arthur Harper, and Alfred Mayo, established a number of trading posts up and down the Yukon River. They also began prospecting during the summers, and recognizing the mineral potential of the area, changed the trading posts from primarily serving native and fur trading populations to serving miners' needs. Several strikes of placer gold between 1885-1893 were fairly small claims; the Klondike discoveries at Dawson in 1897 precipitated an enormous in-migration of people to the area during the 1896–1903 Klondike Gold Rush. During this time, and until the completion of the Klondike Highway in the 1950's, the river was the primary means of transportation in this portion of the world.

Environmental Characteristics

The discharge of the river close to its mouth has been measured as an average flow of 227,000 ft^3/s; however, much of this flow occurs during the summer months as a combination of snowmelt, glacial melt, and rainfall (Brabets *et al*, 2000). There are thirteen major drainage basins systems which contribute flow into the Yukon River. Of those major rivers, the Tanana and the Nenana rivers are also proposed to be impacted, along with the Yukon. Crossings of the Yukon and Tanana would be accomplished by Horizontal Directional Drilling; however, the Nenana would be crossed in two locations by open cut. In addition, trenching and filling of wetlands within the construction right-of-way, material site source impacts and placement of gravel for access roads would result in impacts to wetlands for the construction of the Alaska Stand Alone Pipeline. Wetlands account for about 30 percent of the Yukon River Basin (Brabets *et al*, 2000).

Owing to its history and its location within drainages of mining sites, the Yukon has had considerable disturbance from anthropogenic activity. Mining activity was and still is an important economic activity in the Yukon River Basin. Although modern mining practices are designed to reduce pollution and limit discharges, many historic, abandoned mines remain within the basin. The Coal Creek watershed, for example, which is now part of the Yukon-Charley Rivers National Preserve, was mined extensively in the early 1900's and the mining practices had a severe impact on the watershed. The Coal Creek Mining District was identified as a priority and in 1990, the National Park Service began a multi-year project to restore the ecological health of the watershed, which was funded by and administered through the Superfund response authority of the NPS. The major cleanup effort began in 1994, and was finally completed with the close of the field season in 1998 (Allan, 2015).

The U.S. Geological Survey (USGS), working in cooperation with the Yukon River Inter-Tribal Watershed Council,[1] has been evaluating hydrology and water quality of the Yukon River since the early 2000's. Water-quality samples have been collected at more than 400 sites in the Yukon River Basin by the USGS. While water quality in some areas shows evidence of human-induced historic disturbance, water quality data from the USGS generally indicate relatively good levels of turbidity, metals, and dissolved oxygen throughout the river, and the Yukon River has not been listed as an impaired water body. The water quality of the Yukon River Basin is important for many reasons. Residents who live along the main stem of the Yukon or its tributaries use the surface water for drinking. Salmon and other fish species require adequate water quality for their survival as does the abundant wildlife present in the basin.

In addition to relying on the Yukon River and its tributaries for drinking water, residents who live along the Yukon River have a long history of reliance on fish as a dietary staple, as food for dogs, and for other uses. This includes both salmon and non-salmon species; however, salmon traditionally comprise the bulk of the subsistence harvest within the Yukon River drainage (Alaska Department of Fish and Game, 2017). Fish other than salmon are also important to the subsistence way of life for Yukon area residents in biologically, historically, and culturally significant ways. In 1987 (and reconfirmed in 1993), the Alaska Board of Fisheries made a positive customary and traditional use determination for freshwater fish species in the Yukon area, including other salmonid species such as sheefish, whitefishes, Arctic grayling and Arctic char, as well as Arctic lampreys, burbot, longnose suckers, and northern pike (ADF&G, 2017). At the Yukon Delta National Wildlife Refuge, the U.S. Fish & Wildlife Service lists 44 species of fishes supported in the delta (USFWS, 2017).

Chinook salmon, summer and fall Chum salmon, and Coho salmon comprise the majority of harvests in the Yukon River drainage. The Alaska Department of Fish and Game regulates the harvests of these fish, with the goal of managing for a sustainable harvest. There are limited commercial harvests of salmon within the lower Yukon; however, subsistence harvests typically surpass commercial, sport, and personal use harvests combined (ADF&G, 2017). Within the Yukon drainage, Chinook salmon have been declining since 1998, and in 2010, the U.S. Department of Commerce declared the Chinook fishery in the Yukon a failure (U.S. Department of Commerce, 2010), prompting Congress to approve federal funding for fishery relief in 2012-2013. No harvest other than subsistence has been permitted in the last several years (ADF&G, 2016, 2017). The reasons for the decline in Chinook runs is not known; however, with the exception of a few bumps within the aforementioned timeframe, the strength of Chinook runs has continued to decline in the Yukon. Widespread shortfalls in other river systems in Alaska, beginning in 2007, prompted the Alaska Department of Fish and Game to initiate a research plan to address key research questions, which began in 2013.

In addition to fishing and subsistence activities, the Yukon River basin supports important recreational activities. While most of the basin is wilderness, in the Alaska portion of the basin, there are four national parks; namely, Wrangell-St. Elias National Park, Denali National Park, Yukon-Charley Rivers National Preserve, and Gates of the Arctic National Park. Eight National Wildlife Refuges are also located within the basin. Portions of the Arctic National Wildlife Refuge, and the entirety of the Yukon Flats, Tetlin, Nowitna, Kanuti, Innoko, Koyukuk, and Yukon Delta Refuges are located within the basin. These parks and refuges support significant economic and recreational activities.

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[1] The Yukon River Inter-Tribal Watershed Council, a cooperative effort of 70 First Nations and tribes in Alaska and Canada, has the goal of making the river and its tributaries safe to drink from again by supplementing and scrutinizing Government data.

Tanana River

The Tanana River, which the Alaska Stand Alone Pipeline also proposes to cross, is the second largest tributary basin to the Yukon River and drains approximately 45,000 square miles (ADF&G, 2017). From its headwaters in the Alaska Range, the Tanana River flows 590 river miles to the Yukon River, where it accounts for a 37% increase in the streamflow of the Yukon (Brabets and Schuster, 2008). The Tanana River produces approximately 25% of the Yukon River Chinook salmon, a stock of international importance for commercial, subsistence and sport fisheries in Alaska and Canada (Eiler et al., 2006).

The Tanana River supports eighteen species of fish, three anadromous, and fifteen resident species (ADF&G, 2017; Johnson and Blanche, 2010). In addition, the Tanana River is a major spawning area for whitefish, which are an important subsistence food for rural Alaskans. The U.S. Fish & Wildlife Service has indicated whitefish may travel over 1,000 miles from the mouth of the Yukon to spawn in the Tanana River. Subsistence continues in the present day to be the most valued source of both nutrition and cultural identity for residents of Dot Lake, Tanacross, Tok, Tetlin and Northway (Marcotte, 1991; Martin, 1983). Subsistence harvest comprises a substantial portion of village residents' diets, with most of the harvest consisting of moose, four different species of whitefish, and waterfowl (Marcotte, 1991; Martin, 1983; Andersen and Jennings, 2001).

The Tanana River and its adjacent lands provide residents and tourists with a variety of recreational opportunities such as hunting, fishing, trapping, camping, hiking, dog mushing, cross-country skiing, wildlife viewing, flightseeing, snow machining, gold panning, boating, and berry picking (ADNR, 2017; ADF&G, 2006). The Tanana River flows for 200 miles through the 1.81 million acre Tanana Valley State Forest. At the headwaters of the Tanana River, the 682,602 acre Tetlin National Wildlife Refuge is host to 160 migratory and 30 resident bird species, 42 species of mammals, 15 fish species, one amphibian, and an unknown number of invertebrate species. The Refuge is located in a major migration corridor through which up to 200,000 sandhill cranes, representing about one half of the world population, annually migrate. The Refuge was established primarily for its unique waterfowl values, and produces an estimated 35,000 to 65,000 ducklings annually (USFWS, 2010).

Nenana River

The Nenana River is a tributary of the Tanana River, approximately 140 miles (230 km) long, in central Alaska. It drains an area on the north slope of the Alaska Range on the south edge of the Tanana Valley southwest of Fairbanks. It issues from the Nenana Glacier in the northern Alaska Range, southwest of Mount Deborah, approximately 100 mi (160 km) south of Fairbanks. It flows briefly southwest, then west, then north, forming the eastern boundary of Denali National Park and Preserve. It emerges from the mountains onto the broad marshy Tanana Valley, joining the Tanana River from the south at Nenana, Alaska, approximately 35 miles (56 km) southwest of Fairbanks. The Tanana River continues to its confluence with the Yukon River.

The Nenana supports populations of three species of salmon (coho, king and chum salmon), six other species of salmonids (humpback whitefish, round whitefish, broad whitefish, sheefish, Arctic grayling, least cisco), and seven non-salmonid fishes, viz., lake chubs, burbot, longnose suckers, northern pike, Alaska blackfish, Arctic lamprey, and slimy sculpins (Hander and Legere, 2013). In addition, major archaeological sites located in the valley include Broken Mammoth and Swan Point, of late Pleistocene age (Holmes, 2001).

The Nenana is one of the most popular destinations for boating and whitewater rafting in Alaska. Thousands of users, some on commercial cruises and others on private trips, travel on the river each year. The proximity of the both the Denali Highway and the Parks Highway, which follow various portions of the river, makes the river accessible at many places. For whitewater rafting and kayaking, there are stretches of the river that are rated as Class I, Class II, or Class IV on the International Scale of difficulty. Personal and other water craft are frequently found on the waters of the Nenana.

Wetland Functions in the Yukon Basin

Wetlands in the Yukon basin support the health of the river in a variety of other ways. Wetlands support the physical integrity of the river and its tributaries by acting as sediment traps and by slowing and storing floodwaters, and by providing later releases of stored water during low water periods, which is especially important in maintaining baseflow in headwater and low-order stream systems. They support the chemical integrity of the river and its tributaries by taking up nutrients and sequestering carbon as well as a number of other pollutants, making them unavailable to the aquatic ecosystem. Finally, they support the biological integrity of the river and its tributaries in a number of ways. First, by removing pollutants and excess nutrients from the water column, wetlands ensure that good water quality, which is critical for both fish habitat and human uses, is maintained. Second, they provide breeding grounds for aquatic insects which are critical to the food chain of these waters. Finally, they also provide direct habitat benefits for a number of fish and mammal species. Coho salmon in particular are directly dependent on wetlands as rearing habitat prior to migration to sea, and maintenance of wetlands within the floodplain of the river and its tributaries is critical to maintaining healthy runs of this species.

Permafrost

Permafrost is ground that maintains a temperature below 32^0 F (0^0 C) continuously for a period of two years. Permafrost is present to a large extent in the Yukon River Basin; a number of authors have designated six regions of permafrost in the Yukon River Basin, and the U.S. Geological Survey has identified the percentage of each region: (1) generally underlain by continuous permafrost—16 percent, (2) generally underlain by discontinuous permafrost—40 percent, (3) generally underlain by moderately thick to thin permafrost (50 to 600 ft)—24 percent, (4) underlain by discontinuous permafrost—6 percent, (5) generally underlain by numerous isolated masses of permafrost—5 percent, and (6) sporadic masses of permafrost—9 percent (Brabets *et al*, 2000). The presence of permafrost can drive the formation of wetland areas, since frozen ground is not generally permeable to liquid water, and thus causes water to perch at the surface for long periods of time during the growing season. These areas often develop organic mats and organic soils, which sequester carbon and adsorb and filter dissolved contaminants. Permafrost conditions also contribute to the natural 75- to 120-year cycle of fire in Interior Alaska, which orders the succession of major plant communities.

The presence of permafrost is significant in identifying impacts from development activities. Wetlands occurring in permafrost areas are ecologically fragile and easily disturbed, and do not recover from disturbance quickly, if at all. Brabets *et al* (2000) state:

> If permafrost melts, the upper layers of soil become drier and well aerated. Even if permafrost remains as temperatures increase, the shallow soils that thaw and freeze each year (the active layer) thaw more deeply and develop a thicker unsaturated zone. Soil microbes increasingly oxidize the organic carbon sequestered in the soils. This increased respiration releases carbon, in the form of dissolved carbon, into a stream and the atmosphere. Changes in dissolved organic carbon (DOC) could affect stream aquatic communities at all trophic levels that rely on DOC as a food source. The melting of the permafrost may increase recharge of aquifers, thus increasing base flow in streams. By increasing summer recharge, melting of permafrost will also decrease summer peak flows. Wetlands, which occupy about 30 percent of the Yukon River Basin (fig. 14), could be affected and in turn affect waterfowl habitat in the Yukon Flats and Yukon Delta areas.

Consequently, impacts to wetlands underlain by permafrost can have far-reaching effects on the aquatic ecosystem.

Given the importance of Yukon basin wetlands and water resources for the support of fisheries, wildlife, and subsistence, commercial and recreational uses by humans, the EPA concludes that these resources are Aquatic Resources of National Importance for the purposes of the 1992 Section 404(q) of the Clean Water Act Memorandum of Agreement between the EPA and Department of the Army.

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